



## GST 13 – Configurational and Causal Relationships

### Formal Description

A **relationship** is a physically instantiated connection between entities arising either from configuration or from transfer.

A **configurational relationship** is a relationship arising from the configuration of entities in space-time, without necessarily involving transfer.

A **causal relationship** is a physically instantiated process involving the transfer of matter, energy, or information between entities.

### Complementarity of Relationships

Configurational and causal relationships are complementary. Configurational relationships describe the spatial and temporal arrangement of entities, while causal relationships describe processes of interaction and change.

### Plain English Explanation

So far, we have looked at entities, their boundaries, how they can be grouped into collections and sets, and how they are configured and structured in space-time. The next question is how these entities are connected to one another. These connections are called relationships.

A relationship exists whenever two or more entities are connected in some way. In this framework, such connections arise in two fundamentally different ways: either through configuration or through transfer. This distinction is central to understanding how systems are organised and how they function.

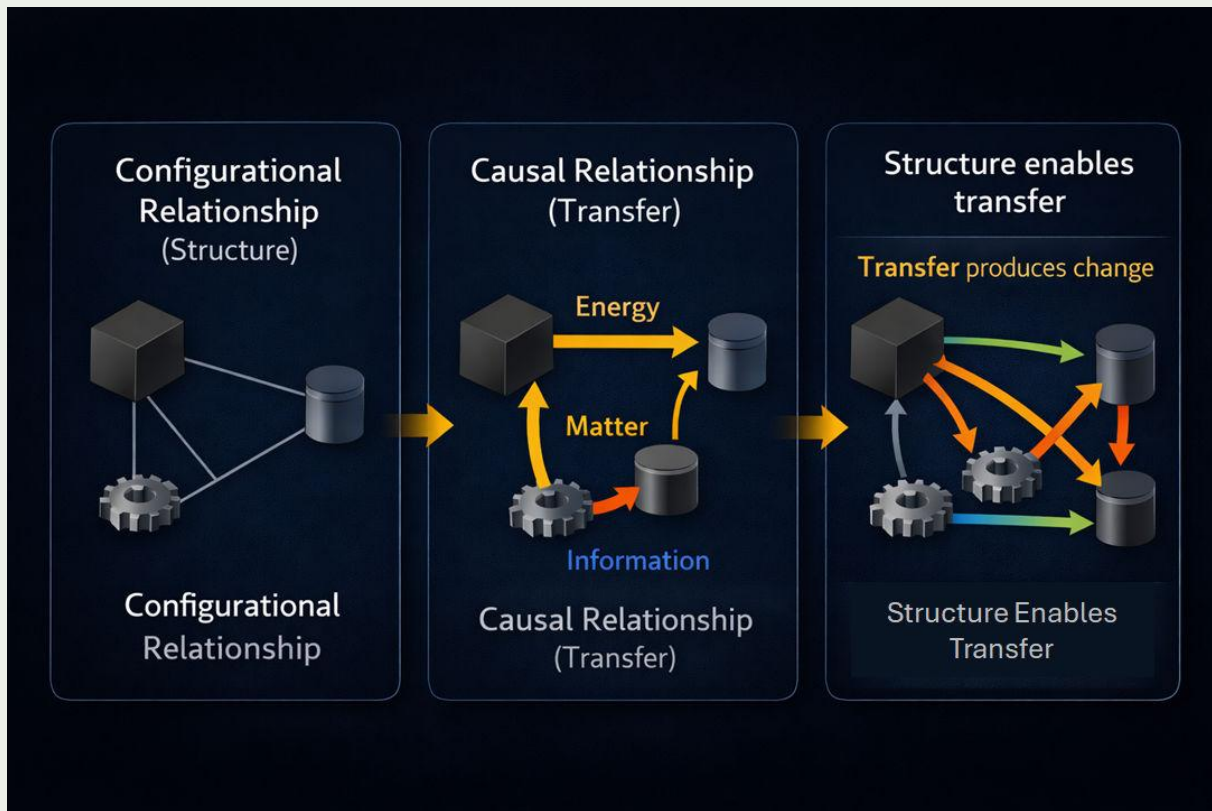
In some cases, entities are related simply because of how they are arranged in space and time. For example, two objects may be next to each other, parts of a machine may be connected together, or individuals may belong to the same group. In these situations, nothing is being transferred between the entities; the relationship exists because of their configuration. These are known as configurational relationships.

In other cases, relationships involve interaction. For example, heat may flow from a hot object to a cold one, a message may be sent from one person to another, or fuel may be burned within an engine. In these situations, something is transferred between entities, i.e., matter, energy, or information, and this transfer produces change. These are known as causal relationships.

These two types of relationships are not separate, but complementary. The configuration of entities determines what kinds of interactions are possible, while transfer describes the processes through which change actually occurs. For example, the wiring of an electrical circuit defines how components are connected, while the flow of electricity through that circuit produces its behaviour. Both aspects are necessary to understand the system as a whole.

This distinction is fundamental to systems theory. Configurational relationships define the organisation of a system, while causal relationships drive its behaviour and change over time.

Together, they provide a complete account of how systems are structured and how they operate.



#### Example 1 – Two Objects on a Table

Two books lying next to each other are related by position.

☞ This is a **configurational relationship**.

#### Example 2 – Heat Transfer

A hot cup of tea warms the surrounding air.

☞ Energy is transferred → a **causal relationship**.

#### Example 3 – A Machine

A machine has:

- parts connected together (configuration)
- energy flowing through it (transfer)

☞ Both configurational and causal relationships are present.

#### Example 4 – Communication

Two people speaking:

- their physical presence creates a configurational relationship
- speech transmits information

☞ This is a **causal relationship enabled by configuration**.



### Provenance and Links

This module draws on foundational ideas from systems theory, cybernetics, and network science concerning the ways in which entities are connected and interact.

The concept of relationships as connections between entities is central to general systems theory, particularly in the work of Ludwig von Bertalanffy, where systems are understood as networks of interrelated components rather than isolated objects. In this context, the organisation of relationships is what gives rise to system-level properties.

The distinction between structure-based and transfer-based relationships aligns with developments in cybernetics, including the work of Norbert Wiener, where systems are analysed in terms of both their organisation and the flows of information, energy, and matter that occur within them.

Cybernetics emphasises that system behaviour arises from the interaction between structural organisation and dynamic processes.

The treatment of causal relationships as processes involving transfer connects to broader scientific understandings of causality in physics and systems theory, where change is understood in terms of interactions involving the movement or transformation of matter, energy, or information.

The distinction between configurational and causal relationships also aligns with network science, in which systems are represented as nodes and connections. In this context, structural connections define possible pathways, while flows along those connections represent dynamic processes occurring within the network.

Within General Systems Theory, these ideas support a unified understanding of how systems are organised and how they operate. Configurational relationships define the arrangement of entities in space-time, while causal relationships describe the processes through which systems change.

Together, they provide a foundation for analysing events, processes, and system behaviour in subsequent modules.

### Practical Exercise

Choose one real-world system (for example: a household appliance, a social interaction, or a natural system).

1. Identify at least one **configurational relationship**
2. Identify at least one **causal relationship** (transfer)
3. Explain how configuration enables or constrains causal interaction

👉 Write a short paragraph describing both types of relationship.